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Understanding the Importance of Harmonized Landscape Design for Forest Education Centers in Malaysia

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Abstract

The Forest Education Centre is a place that provides environmental education facilities where the community, teachers and students can visit to learn more about the forest environment. Therefore, landscape design elements' in this area which include buildings, should be visually in harmony with the sense of place and its surroundings. The design must concern form, color, materials, landscape degradation and preservation of natural processes. Unfortunately, landscape design elements in this area have been built based on in-situ approach where the absence of a 'code of design' in creating a well-built environment of landscape and architectural quality has contributed to inharmonious designs. This had led to the significant function of identity and meaning in securing the sense of place which was not adequately examined in the process. Therefore, the aim of this paper is to raise awareness among the stakeholders and the sensitivity towards the importance of harmonizing design in Forest Education Centres. Among the objectives of this study is to firstly understand the user's perception towards harmonies designs in a forest environment. Secondly, it is to suggest harmonies design approaches towards forest sustainability. The intended audience for this paper include directors, facilities managers, landscape architects, forest officers, architects and engineers.

Keywords: Forest, harmonize landscape design, education, sustainability

1. Introduction

Malaysia's forests are rich in species amidst an extremely complex ecosystem [1]. The world has focused on Malaysia's forests due to their functions, uniqueness and is considered as one of the world's mega-diverse countries ranked 12th in the world on the National Biodiversity Index [2]. Major forest types in Malaysia include the lowland dipterocarp forest, hill dipterocarp forest, upper hill dipterocarp forest, oak-laurel forest, montane ericaceous forest, peat swamp forest and mangrove forest. In addition, there are also smaller areas of freshwater swamp forest, heath forest, forest on limestone and forest on quartz ridges. Generally, forests play an important role in human life that makes it vital to be protected from deforestation and other negative impacts. Any unsustainable human interventions in a forest environment could also affect the climate, ecology, biodiversity, economy and

health which in turn, will affect human life as well as other living things. Forests play a role in terms of climate when it puts up a defense against climate change and removes the greenhouse carbon dioxide gas. This helps to generate oxygen that assists in purifying the atmosphere and controlling rising temperatures. From the ecology aspect, forests prevent erosion by reducing the rainfall's force on the soil's surface, absorbing water and not allowing it to directly flow away and removing topsoil. Moreover, forests are storehouses of the planet's biodiversity, which includes flora and fauna, relating to food chains which are vital for human lives. Deforestation will destroy the food chains, thus, for economic benefits, the forest is a place for locals to generate their incomes through forest products trade such as forest fruits and fuel wood. Forests also provide opportunities for people to do outdoor or recreational activities such as walking, exercising, and jogging which would help them develop a healthier lifestyle.

The related regulations that affect forestry for Malaysia include the Land Conservation Act 1960, Environmental Quality Act 1974, National Parks Act 1980, Protection of Wildlife Act 1972, National Land Code 1965, Aboriginal Peoples Act 1954, Occupational Safety and Health Act 1994 and Forest Rules 1985 for Peninsular Malaysia. Meanwhile for Sabah, the relevant regulations include Forest Rules 1969, Wildlife Conservation Enactment 1977, Land Ordinance 1930, Cultural Heritage (Conservation) 1997, Sabah Parks Enactment 1984, Biodiversity Enactment 2000, Conservation of Environment Enactment 1996, Water Resource Enactment 1998, and Environmental Quality Act 1974. In addition, Sarawak has the Natural Resources and Environment Ordinance 1997, Forest Rules 1962, Wildlife Protection Ordinance and Rules 1998, The Forests (Planted Forest) Rules 1997, Sarawak Biodiversity Centre Ordinance 1997, Sarawak Biodiversity (Access, Collection & Research Regulations) 1998, Land Code 1958, Natural Resource and Environmental Ordinance, Water Ordinance 1994, Occupational Safety and Health Act 1994, Land Ordinance 1952, Native Code 1992, Native Code Rules 1996, and Native Custom Declaration 1996.

Furthermore, to ensure the forest areas in Peninsular Malaysia are protected, the Malaysian Government has classified the Permanent Reserve Forest (PRF) into various functional classes. Those classifications consist of Timber Production Forest, Soil Protection Forest, Soil Reclamation Forest, Flood Control Forest, Water Catchment Forest, Forest Sanctuary for Wildlife, Virgin Jungle Reserved Forest, Amenity Forest, Education Forest, Research Forest, Forest for Federal purposes, and State Parks [3]. The main aim of the classification is to manage the forest for various forest services and economic importance, while the forest quality is maintained to ensure the resources are sustainably managed. However, this would depend on the government's efforts in conserving and protecting the forests, which is not enough. We need to educate people about this matter and help all ages to understand and appreciate our country's natural resources and teach them how to conserve those resources for future generations. Therefore, the establishment of Forest Education Centers should be given credit since these centers enables people to realize how natural resources and ecosystems affect each other and how resources can be used wisely. Nevertheless, the development of these centers must be in harmony with the surrounding landscape.

Consequently, any development planned in the forest should consider the design aspect accordingly. The designs must be in harmony with the natural forest landscapes along with their own unique features that highlights the forest identity, besides being sites of recreational activities [4]. Furthermore, its designs should have good combinations between the natural environment and architectural aspects, for example, application of vernacular architecture [5]. Design of architectural structures (e.g. walkways, benches, signage's, shelters) and buildings, must be

visually in harmony with the surrounding natural environment [6]. Forests with high panoramic values should have buildings with good style that is in harmony and does not contradict the existing environment [7]. Ceballos-Lascurain [8] and Walter [9] suggested that the most important consideration was that the structure and building designs in the forest must highlight aspects of the surroundings.

No doubt, the process of a new building or infrastructure at the Forest Education Center must be planned well before implementation to ensure natural landscape resources (e.g. Forests, rivers, hills, waterfalls, geological, etc.) are continuously protected and preserved. It is also to guarantee that human made landscape elements can be in harmony with the existing environment. Buildings or infrastructure must conform to environment-friendly, low-impact architecture; renewable including solar energy, waste recycling, rainwater harvesting, natural cross-ventilation, no use of asbestos, controlled sewage disposal, and merging with the surrounding landscape. The design should enhance local architecture, use local materials as well as portray the local art and culture.

This was the main concern with the Forest Education Center as it is in their discussions to develop landscape designs, especially the landscape architectural images. The aim of this paper is to raise awareness among the stakeholders and the sensitivity towards the importance of harmonizing design in Forest Education Centres. Among the objectives of this study is to firstly understand user's perception towards harmonious designs within the forest environment. Secondly, it is to suggest harmonies design approaches on Forest Education Centres in Malaysia towards forest sustainability.

2. Forest education centre

The forest education centre is a place which provides environmental education facilities that community, teachers and students can visit to learn more about the forest environment, its importance and what people can do to help protect it. This centre promotes conservation of natural ecosystems, education focused on forest stewardship, and research related to forest ecology and management. Therefore, development of this site should be carefully focused on restoration, preservation, conservation, protection of natural systems and maintaining nature for its sustainability. Bear in mind that a sustainable forest environment is a forest that is carefully focused on restoration, preservation, conservation, protection of natural systems, maintaining natural function and the structures/buildings harmonizes with the landscape. Meanwhile, landscape design elements' developments such as buildings, shelters, benches, signage, information boards, roads, bridges, walkways, picnic tables and stairs should portray their identity and is in harmony with the sense of place. The design should have a good combination of a natural environment and architectural characteristics, such as the application of vernacular architecture. The designs should be visually in harmony with the surrounding natural environment and concerns form, color, materials, landscape degradation, preservation of natural processes, and protection of biological diversity.

One of the latest forest education centres in Malaysia is located in Ayer Hitam Forest Reserve, Puchong, Selangor. This area is also known as the Sultan Idris Shah Forestry Education Centre (SISFEC) and was awarded to Universiti Putra Malaysia through a long-term agreement to conduct activities regarding education, research and development in the field of forestry. SISFEC covers an area of about 1, 1761.1 hectares and has become an educational reference centre, research and development centre for good practice in tropical forest management at national level, as well as globally. This centre acts as an outdoor laboratory for students in their

efforts to develop skills in forest management where they can gain more knowledge and skills in classifying trees and plants, learning about soil science, tree inventory, silviculture, ecology, wildlife, outdoor recreation and eco-tourism. Due to that, their landscape has changed, and many facilities had been developed to fulfill their establishment goals and objectives.

However, the question here is whether the development of those facilities is in harmony with the forest environment in terms of its identity and whether it is sustainable or not? It was argued that as much as the natural environment contained in the forests, the built environment influences the visitors' experience and impressions about how the management is fulfilling its mission of stewardship. This means, the landscape designs, especially the facilities in forest education centres must be fitted to forest setting, carefully constructed and meets the user's needs. This also shows that, landscape architectural identity of forest education centers is a very important focus as a way of showing respect towards the spectacular scenery and landscape settings, as well as to conserve natural resources. As a result, a good experience could be delivered to the user.

3. What is harmonized landscape design?

Harmonious landscape design can be referred to as the subordination of a structure to the environment and having buildings blended in with the landscape. The materials used, scale of the structure/building and form appears to fit into the existing landscape context. Materials used also need to reflect regional materials and be sympathetic with traditional forms and the existing landscape. It should also be a continuity of form, materials, colors and details among the structure/building within the existing area.

Harmonious landscape design is also closely related with identity. Nowadays, identity has been brought on the agenda of planners and designers to capture the concept of sustainability of place identity [10]. Here, place identity is strongly associated with the emotional type of attachment formed as a result of users' engagement and identification with places through activities and people that they have associated with [11]. Thus, the forest education centre's identity is reflected in the attributes of physical form (landscape architecture) and learning activity as well as the users' perception of the corresponding characteristics. It is also more than just the physical appearance but involves a "meaning" for the individual and the community [10]. At this point, researchers strongly believed that landscape architectural identity is also essential for the user's psychological existence and well-being which contributes to harmonious design. Norberg-Schulz [12] claimed that the architecture itself provided a physical attribute to space which facilitates habitation of the users as well as their mental and physical well-being. Therefore, landscape design elements in forest education centres must pay attention to the physical attributes of the forest setting to ensure it becomes an interesting outdoor education site.

Landscape design elements in forest education centres should consider a unique feature that highlights the forest identity [4]. The design should have a good combination between the natural environment and architectural aspects, for example, application of vernacular architecture [5]. On the other hand, the structure designs (e.g. pedestrian paths, signage's, shelters, etc.) as well as buildings must be visually in harmony with the surrounding natural environment [6]. Harmonious relationships of facilities with park landscapes should now include, in addition to concerns about form, color, and materials, along with concerns about issues such as landscape degradation, preservation of natural processes and protection of biological

diversity [13]. On another aspect, Ceballos-Lascurain [8] and Walter [9] suggested that the structure and building designs in the natural setting for e.g. a recreational forest must highlight aspects of the surroundings. Therefore, the current development of our landscape design elements in forest education centers needs to be assessed, upgraded, developed or rehabilitated to improve their presentation of attractions.

Unfortunately, landscape design elements in forests are being built on an adhoc or in situ approach with the absence of a 'code of design' in creating a well-built environment of landscape and architectural quality [14]. This has contributed to inharmonious designs which led to the significant function of identity and meaning in securing the sense of place which was not adequately examined in the process. If this situation continues, it could raise an "abandon" syndrome which refers to unsafe guarding, unsustainability and conserving less of the surrounding natural and cultural heritage of the site. Whether or not this is realized, it could be observed that most of the landscape design elements in forest areas are quite similar with urban parks, for instance, the wakaf or shelter, pedestrian walkways and benches. This is true because most of their development are caught in the homogenizing forces of the mass media and are repeating the mediocrity of international fashion [15]. As a result, an identity crisis is displayed with its implications on architectural expression (for both building forms and landscape) resulting in harmonies design being neglected.

4. The need to harmonize landscape design for forest education centres

The need to have harmonized landscape designs for forest education centres would include the points below:

- i. *Key to Sustainable Development Practices.* One of the primary aims of landscape design is to integrate human technology (buildings or other structures) with its natural environment. Its efforts are to achieve a better balance between the function and beauty, respect the character of the landscape and its sensitivity. Creation of environmental harmony through the objects provides a good relationship that brings balance and harmony to living beings, presents a quality of things agreeing, suitable and appropriate, as well as portraying the cultural value. Thus, applying harmony landscape designs has become one of the approaches to reach sustainable development for forest education centres.
- ii. *To increase visual quality of the park.* Harmonize landscape design can increase the visual quality of the forest education centre because its design considers the buildings or structures to blend in with the landscape, applying appropriate colors and roof textures, foundation plantings, rough rock footings, and battered walls. What people see can influence how they feel and behave in the forest education centre. The user always expects to have quality experiences in the park through all the five senses, which is seeing, hearing, touching, smelling, and even tasting. Therefore, having buildings or structures blend in with the landscape is vital as it helps in increasing the visual quality of the park.
- iii. *Provide appropriate education and enjoyment to user.* The aim of establishing forest education centres was to promote conservation of natural ecosystems, education focused on forest stewardship, and research related to forest ecology and management. Meanwhile, harmony landscape design

objectives are to provide user and management facilities which are harmonious and visually pleasing in their simplicity and that, wherever possible, provide interpretation/information opportunities. Having harmonized landscape design with better planning of forest education centers will provide the users with a good learning environment and quality experiences. Furthermore, managers of forest education centres are often charged with protecting natural resources for future generations and providing appropriate user enjoyment.

- iv. *Keys to guiding the selection of the most appropriate management responses.* Proactive strategies that embrace users and their perceptions towards forests should be developed to improve the health of park systems, wilderness areas and recreation destinations, including forest education centres. In this context, landscape design has a crucial role to play in achieving sustainability and to provide solutions for environmental problems. Therefore, understanding the need of harmonizing landscape design and their own impacts on the environment is a key to guiding the best building or structure design, as well as the most appropriate management responses. Furthermore, today's landscape design movement tends to address design problems.
- v. *Approaches to conservation of cultural landscapes.* Landscape design has a significant impact on how users perceive and use the park. Thus, implementing harmony landscape design in forest education centres could provide a special character in which the values of the park are clarified and reinforced with cultural landscapes. Then, environmental education in forest education centres become more meaningful when it enables people to gain an understanding of how cultural values affect the environment. Cultural landscapes are a legacy for everyone. These special sites reveal aspects of our country's origins and development as well as our evolving relationships with the natural world. They provide scenic, economic, ecological, social, recreational, and educational opportunities helping communities to better understand themselves.

5. Methodology

The Sultan Idris Shah Forest Education Centre (SISFEC) was selected for a case study as it is one of the newest forest education centers in Malaysia located in Ayer Hitam Forest Reserve, Puchong, Selangor (**Figure 1**). Case studies were used because they are applicable to real-life, contemporary, human situations which allowed researchers to explore and investigate the contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships. Furthermore, it allowed the researchers to go beyond the quantitative statistical results and understand the behavioral conditions through the actor's perspective [17]. Yin [18] defined the case study research method "as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between the phenomenon and context are not clearly evident; and in which multiple sources of evidence are used."

To understand user's perception towards harmonies landscape design in forest education centers, data was gathered through a survey using a questionnaire with photographs as surrogates of the actual environment. A set of photos that show the landscape design elements in this center as attached to the questionnaire set, was

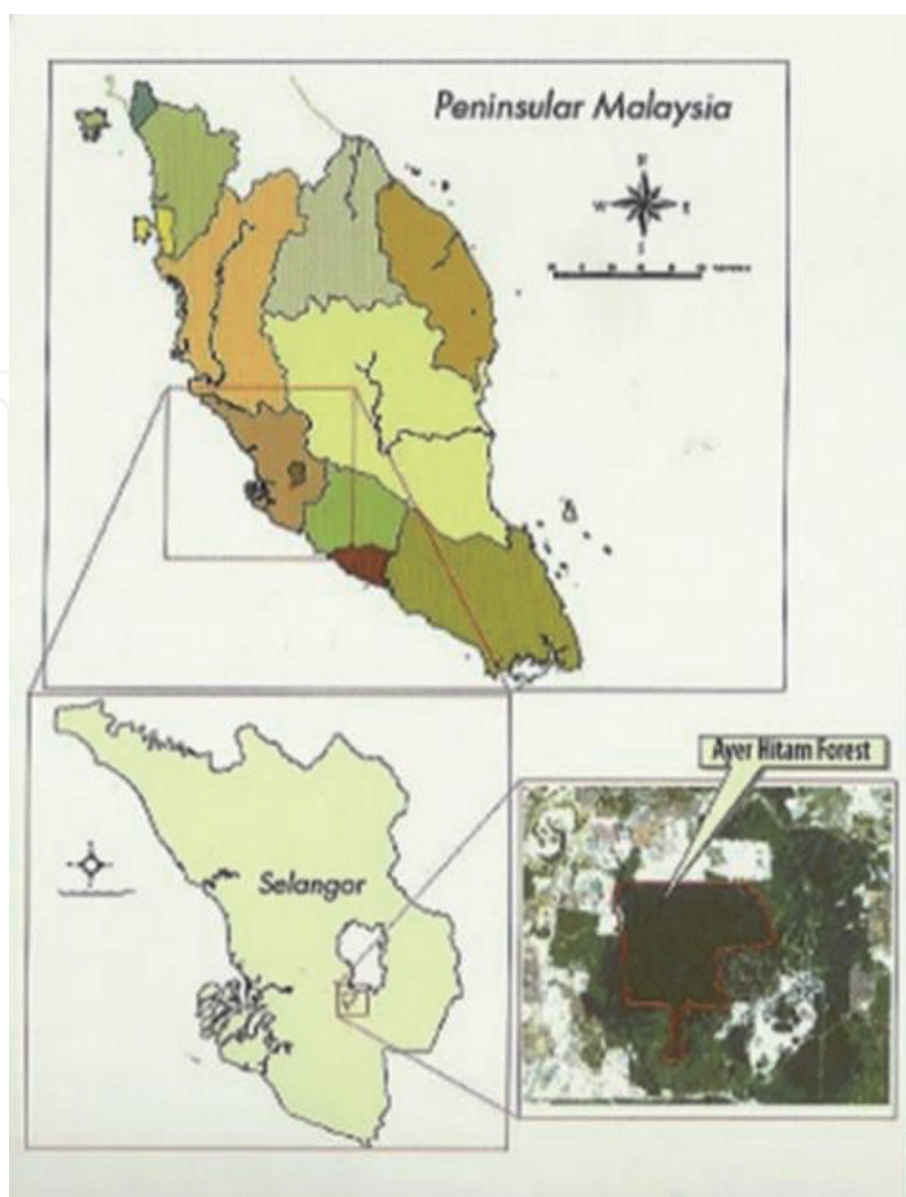


Figure 1.
Location of SISFEC at $3^{\circ}00'53''\text{N}$ and $101^{\circ}38'51''\text{E}$ [16].

prepared. The landscape design elements were divided into two categories (**Figure 2**). The first is the Buildings, which consist of the administration block, lecture hall, laboratory and chalets. Second includes Other Facilities consisting of a gazebo, walkway, boardwalk, outdoor toilets, guardhouse, signage, lighting, seating, railing and planter box. The landscape design elements are evaluated through the application of form, color, material, details and style/concept. These elements are the considerations that must be well thought out before the design work starts. It is obvious here to say that those elements were one of the factors that influenced perception. This is because forests have their own nature, and characteristics in it are an infinite variety of shape, colors and species living to gather in a perfect, logical, unquestionable way [19].

With the support of photographs, the respondents were questioned on the level of harmonizing for each of the elements based on four (4) Likert Scale. The scales are; 1 is not harmonize, 2 is slightly harmonize, 3 is harmonize and 4 is well harmonize. Each level of answer has the guided description for easier understanding (**Table 1**).

The survey was conducted in September 2019 until November 2019 and was basically carried out on weekends to target a higher number of respondents since



Figure 2.
Categories of landscape design elements used in survey (source: Authors, 2019).

Harmonize Aspect Likert Scale	Explanation
Form	1 Form does not harmonize with natural character of forest environment.
	2 Form slightly harmonizes with natural character of forest environment.
	3 Form harmonizes with natural character of forest environment.
	4 Forms are well harmonizing with natural character of forest environment and enhances the identity of SISFEC.
Color	1 Colors are too contrasted and does not harmonize with natural character of forest environment.
	2 Colors slightly harmonize with natural character of forest environment.
	3 Color is harmonized with natural character of forest environment.
	4 A color is well harmonizing with natural character of forest environment and enhances the identity of SISFEC.
Material	1 Material does not harmonize with natural character of forest environment
	2 Material slightly harmonize with natural character of forest environment
	3 Material used is harmonized with natural character of forest environment.
	4 Material used is well harmonize with natural character of forest environment and enhance the identity of SISFEC.

Harmonize Aspect Likert Scale	Explanation
Style/Concept	1 Building design's Style/Concept does not harmonize with natural character of forest environment.
	2 Building design's Style/Concept slightly harmonize with natural character of forest environment.
	3 Building design's style/Concept harmonizes with natural character of forest environment.
	4 Building design's style/Concept well harmonize with natural character of forest environment and enhance the identity of SISFEC.
Details	1 A detail does not harmonize with natural character of forest environment.
	2 Details slightly harmonize with natural character of forest environment.
	3 Details are harmonizing with natural character of forest environment
	4 Details are well harmonizing with natural character of forest environment and enhance the identity of SISFEC.
Overall Space Planning	1 Overall space planning does not respect the natural character of forest environment.
	2 Overall space planning slightly respects with natural character forest environment.
	3 Overall space planning respect with natural character of forest environment.
	4 Overall space planning respect the natural character of forest environment well and enhance the identity of SISFEC.
Summary of Landscape Architectural Image	1 Form, Color, Material, Details and Style/Concept of the Overall Architectural Image does not harmonize with natural character of forest environment.
	2 Form, Color, Material, Details and Style/Concept of the Overall Architectural Image are slightly harmonizing with natural character of forest environment.
	3 Form, Color, Material, Details and Style/Concept of the Overall Architectural Image are harmonizing with natural character of forest environment.
	4 Form, Color, Material, Details and Style/Concept of the Overall Architectural Image are harmonizing well with natural character of forest environment and enhance the identity of SISFEC

Table 1.
Likert scale of harmonize landscape design.

most education activities were held off during this period. A total of 150 respondents participated in the study. However, one respondent did not complete the survey form and was rejected; which resulted in 149 respondents only. In addition, respondents were selected based on onsite availability and their willingness to become participants. With help from the SISFEC staff, these groups of respondents were identified. Then, they were briefed on the procedure and were supplied with self-administered photo-questionnaires. The researchers were available to assist the respondents if they faced difficulties while answering the questionnaire.

The data gathered was analyzed using SPSS package version 24, using mean, frequency, percentage, Cronbach's alpha and reliability test.

6. Results and discussion

Questionnaire items were tested for reliability using Cronbach's alpha analysis to assess the internal consistency reliability of the questionnaire. According to Schmitt [20] and Spek et al., [21] an alpha of ≥ 0.7 was considered reliable. Therefore, the

Alpha Value for each variable used in the study is high in reliability standards and consistent with the value of 0.924 (**Table 2**).

Generally, respondents of this study perceived that the landscape design of SISFEC is slightly harmonized to harmonize with the mean score from 2.52 to 3.12 (**Table 3**). Only variable “Overall Space Planning” has a mean score of more than 3.00 which indicated the agreement on that design element has achieved the “harmonized” level with surrounding forest environment. The lowest mean scores with 2.52 are building’s “form” and “material” where the respondents have high inclinations towards the harmonized level of design. Overall, respondents perceived the landscape and architectural image in SISFEC as harmonize with surrounding environment (mean score 2.74).

Meanwhile, **Table 4** shows in detail the frequency of each variable of respondents’ perception on landscape design in SISFEC. Results had shown that 36.2% of respondents perceived the form of the buildings in SISFEC blend with the existing forest environment, whereas 14.1% of them thought the form was well blend with the forest environment. The respondents also perceived other facilities in SISFEC were blend (53.0%) and well blend (20.1%) with the forest. This had revealed that buildings and other facilities form in SISFEC was acceptable and in harmony with the existing environment. Form is one of the most important variables and has evocative effects on the way people perceive the surrounding as patterns. Thus, the best way to produce a harmonize design in the forest education center was the integration of park development with the landscape form, using native materials, textures, colors and respecting culturally significant resources. This study also observed that most of the building forms in SISFEC have a local architectural influence whereby Malay architecture is displayed on their roof style known as Bumbung Perak or ‘Dutch style roof ridge’ (**Figure 3**). This roof has been transformed into modern design where the slope of the roof is gentler, and the length of the eaves is also shorter. According to Riry [22], the application of

Variables	Alpha Value
Harmonize Aspect	
1. Buildings	
a. Form	0.915
b. Color	0.920
c. Material	0.920
d. Style / Concept	0.915
2. Building Details	
a. Details	0.914
3. Other Facilities	
a. Form	0.917
b. Color	0.919
c. Material	0.917
d. Style / Concept	0.913
4. Overall Space Planning	0.921
5. Summary of Landscape and Architectural Image	0.912

Table 2.
Alpha value for each variable.

traditional roof design in nature parks is suitable with the surrounding environment since the materials used are available locally such as wood and bamboo that enhances the harmonize design. Furthermore, simple traditional forms applied in

Variables	Mean	Standard Deviation
Harmonize Aspect		
1. Buildings		
a. Form	2.52	0.882
b. Color	2.54	0.904
c. Material	2.52	0.920
d. Style / Concept	2.65	0.961
2. Building Details		
a. Details	2.78	0.899
3. Other Facilities		
a. Form	2.87	0.799
b. Color	2.78	0.818
c. Material	2.86	0.811
d.Style / Concept	2.80	0.860
4. Overall Space Planning	3.12	2.74
5. Summary of Landscape and Architectural Image	2.74	0.823

Table 3.
Mean & standard deviation of landscape design.

Variables		Frequency	Percentage (%)
Haemonize Aspect	Likert Scale		
1. Buildings			
a. Form	1 not blend	18	12.1%
	2 slightly blend	56	37.6%
	3 blend	54	36.2%
	4 well blend	21	14.1%
b. Color	1 too contrast and not harmonize	21	14.1%
	2 slightly harmonize	47	31.5%
	3 harmonize	60	40.3%
	4 well harmonize	21	14.1%
c. Material	1 does not blend	21	14.1%
	2 slightly blend	52	34.9%
	3 blend	53	35.6%
	4 well blend	23	15.4%
d. Style / Concept	1 does not suite	22	14.8%
	2 slightly suite	37	24.8%
	3 suite	61	40.9%
	4 well suite	29	19.5%

Variables		Frequency	Percentage (%)
2. Details			
a. Details	1 does not blend	15	10%
	2 slightly blend	35	23.5%
	3 blend	67	45%
	4 well blend	32	21.5%
3. Other Facilities			
a. Form	1 not blend	9	6%
	2 slightly blend	31	20.8%
	3 blend	79	53%
	4 well blend	30	20.1%
b. Color	1 too contrast and not harmonize	9	6%
	2 slightly harmonize	41	27.5%
	3 harmonize	72	48.3%
	4 well harmonize	27	18.1%
c. Material	1 does not blend	8	5.4%
	2 slightly blend	35	23.5%
	3 blend	75	50.3%
	4 well blend	31	20.8%
d. Style / Concept	1 does not suite	11	7.3%
	2 slightly suite	38	25.5%
	3 suite	69	46.3%
	4 well suite	31	20.8%
4. Overall Space Planning			
Overall Space Planning	1 does not respect	5	3.4%
	2 slightly respect	26	17.4%
	3 respect	64	42.9%
	4 well respect	54	36.2%
5. Summary			
Summary of Landscape Architectural Image	1 does not harmonize	10	6.7%
	2 slightly harmonize	44	29.5%
	3 harmonize	69	46.3%
	4 well harmonize	26	17.4%

Table 4.
Frequency & Percentage of landscape design in SISFEC.

SISFEC allows the buildings to fit in with their neighbors and creates a balance with the existing environment.

In terms of color applied to buildings, 40.3% respondents perceived that the color was in harmony with the existing environment and 14.1% of them saw it as well harmonize with the surroundings. Respondents also perceived the color of



Figure 3.
A Malay traditional roof style of chalet in SISFEC (source: Authors, 2019).

other facilities was harmonizing (48.3%) and well harmonized (18.1%) with the forest setting. Here, the researchers understood that the respondents were pleased with the color used in the area since the color was not so different with the natural setting (**Figure 4**). Colors on existing park structures include brown, beige, and light pink. Overall, these colors are compatible with the colors found naturally in the surrounding environment. Bear in mind that color can create visual sensations other than emotional ones as well as can be used to simplify the forms and to break a building mass into smaller parts [23]. Therefore, the park management had given good consideration on the color effect of every element of a building, from the earthy colors of primary construction materials like wood, stone, brick, and marble, to the expansive variety of colors available for paint, doors, windows, siding, and trim. As a result, the colors are in harmony with the existing ambiance.

An analysis was conducted on materials, where the results are shown in **Table 4** that 35.6% respondents perceived that materials used is blend and 34.9% of them claimed the materials was slightly blend with the existing forest environment. They also agreed that materials of other facilities were blend (50.3%) and well blend (20.8%) with the forest condition. These results show that respondents have high inclinations towards the harmonized materials used in design. Building materials used in SISFEC include masonry block, stucco, wood, concrete, stone, and metal (on small features, such as railings) (**Figure 5**). The combination of materials used in existing building blends well with the natural environment. This is in line with the suggestions by Lippsmiller [24] and Schmid [5] who encouraged the use of local materials for construction works in protected areas, such as forests for sustainability purposes.



Figure 4.
Colors applied to the buildings and other facilities such as signage was harmonized with the existing environment (source: Authors, 2019).



Figure 5.
Building materials used in SISFEC include masonry block, concrete, stone and metal (source: Authors, 2019).

From the aspect of style or concept, SISFEC had applied a sustainable development or green technology concept. The architecture of the main complex was designed in modern forms that are innovative in construction technologies, particularly the use of glass, steel, and reinforced concrete (**Figure 6**). The administration building and lecturing halls were linked with boardwalks. There is also an observation tower at the Lecture Hall for students to view the forest's panoramic scenery surrounding the building. Each block was equipped with internet and Wi-Fi connections as well as CCTV for security purposes. The public can view tall and big trees around these buildings as well as small vegetation growth, untouched under the canopy. The researchers believe that this design approach was to harmonize the building with its physical surroundings, enhance community awareness, while reducing environmentally polluting substances to achieve a balance between man and the surrounding features. It is no wonder that 40.9% of the respondents saw that they are suited and 19.5% of them had perceived the style/concept of buildings in SISFEC was well suited with the forest environment, respectively. Respondents also perceived that other facilities such as boardwalk were also suited (46.3%) and well suited (20.8%) with the forest setting. It should also be stated here that SISFEC has implemented a green design approach where the building design tries to minimize the harmful effects of construction projects on human health and the environment [25].

In relation to details of building structure which includes the foundation, floors, walls, beams, columns, roof, stair, etc., this study found that almost half of the respondents (45.0%) perceived that the details part of buildings and other facilities in SISFEC blend in with the forest setting. Meanwhile, 21.5% of them claimed the details blend well with the forest environment. The other 23.5% of them saw it as slightly blending in with forest ambience. However, these figures had shown that



Figure 6.
Buildings in SISFEC had applied a green technology concept (source: Authors, 2019).

the respondents were more inclined towards harmonizing design where they made up a total up 90%. This is because they presume that the texture of bricks matches with the typical local area and the modern materials such as glass are to be used with care to maintain local character and achieve the aims of thermally efficient and sustainable building.

Furthermore, the footing system (**Figure 7**, right) was applied to buildings at certain parts and bridges (boardwalk) being built to connect each chalet in the lower areas that shows construction sensitivity. Additionally, retaining walls were constructed along the roads to protect them from soil erosion. This demonstrates that the management is very sensitive towards the natural environment and has minimized further disturbance. Indirectly, these efforts have created a harmonize environment and have protected the degradation of the existing landscape as well as enhancing the beauty of this area.

Finally, respondents were asked to rate the SISFEC space planning (**Figure 8**), whether the site has respected the existing environment or not. Results in **Table 4** had shown that 42.9% of the respondents perceived the space planning as giving



Figure 7.
Details of building and other facilities in SISFEC (Source: Authors, 2019).

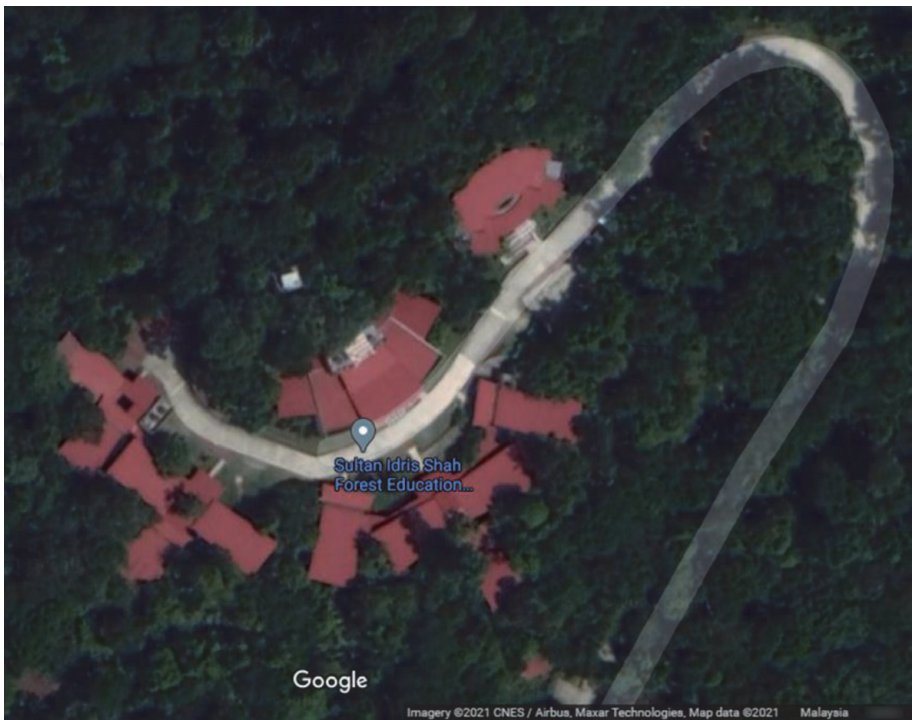


Figure 8.
SISFEC space planning (source: Google earth pro, retrieved on 5 mac, 2021).

respect to the existing environment. Meanwhile, 36.2% of them perceived it was well respect in the current environment. This is because the respondents saw the natural landscape has been conserved properly and kept in good condition. They noticed that tree cutting was strictly not allowed and the slope was kept in a natural setting and untouched, while major erosion was not found. The site still contains an untouched river landscape enclosed by the surrounding hills and have not suffered great disturbance. The most important thing is the buildings are not too huge and provides a contrast with the existing environment as well as the architectural features and details associated with local styles.

As conclusion to the findings, researchers understood here that harmonized landscape design is vital for Forest Education Centers to give users a closer look on nature and the architectural design to co-exist in mutual respect. Respondents of this study have expressed their perception when they rated the landscape design in SISFEC as harmonizes and inclined to well harmonize design. The summary of landscape architectural image in **Table 4** shows that 46.3% and 17.4% of the respondents perceived the design was harmonize and well harmonize, respectively. However, 29.5% of them claimed the design was slightly harmonized. It must be highlighted here that people give value to forest landscape that include esthetics, functional, and ethical values. Therefore, the park management should be aware of this and make an effort to improve and ensure all landscape design an element in SISFEC is in harmony with the forest environment.

Results of this study have emphasized that a good understanding of landscape design elements is necessary in creating a harmonize design. Each element is a crucial part of a visual message, and the combination of these has an impact on how the design is perceived. Thus, landscape design works should be made in agreement with the desires and demands of the tourists who spend their time in outdoor environments [26]. On another aspect, this study had shown that environmental harmony can be achieved when the aspect of consciousness and essence, aspect of energy and vitality and aspect of physical form being unites with each other [27]. Learning from the past as a source of possibility and inspiration for creating harmonious environments was also demonstrated as a good lesson.

This study also portrays that landscape design elements provide designers the ability to evaluate and deconstruct other designs as well as looking at a design from its basic, raw elements that would help a designer make certain decisions. Since forests are natural areas, therefore those who are involved in forest education centre's planning and development must perceive the site as a living being which leads towards environmental harmony. On this basis, it is necessary to consider the biological impacts of the negative effects of facility construction on the biological environment and their indirect impacts on the rational layout of land used in Forest Education Center planning, aiming to create a multi-directional interaction mechanism between ecological, economic, and cultural elements in this area [28].

7. Suggestions/recommendations

Designing a Forest Education Centre is a true challenge on the application of harmonizing design approach which considers the relationship between man-made structures and the surrounding natural environment. A harmonize landscape design approach has been applied since early human civilization. It shows interdependently strong the force was between nature and the need for human habitation. Through the test of time, the design approach had evolved in the theoretical framework, but the goal remains in finding commonality between architecture and natural environment.

It was suggested here that the development of forest education center in Malaysia should use a green building materials in construction activity such as lime, sand-lime brick, eco-friendly tiles and colored plaster, which are more effective than the conventional materials. Those said materials can be reused, renewed or recycled, sustainably harvested, rapidly renewable, non-toxic, and local without adversely polluting the environment. The structures or buildings should be painted using eco-friendly paint or low volatile organic compound coatings to eliminate potential health hazards and improve indoor living environments.

Some harmonize design approach in architecture that can be applied for Forest Education Centers are Eco-architecture, Organic Architecture, Vernacular Architecture and Green Building. These design approaches are the labels of architectural style with the same objective to achieve a harmonize design goal. The harmonize design approach play a vital role in establishing a Forest Education Center for the function of environmental education and awareness in an Educational Forest as well as to minimize the conflict between forests, urbanization and the environment for a sustainable development in the communities, region and the world. The management of Forest Education Centers can choose one of the proposed approaches depending on the site suitability. Additionally, a combination of the proposed approaches also could be applied depending on site suitability.

i. Eco-Architecture

Eco-Architecture means the application of ecological principal to architecture, typically in the design of building which promotes environmental conservation that harmonizes with their natural surroundings. An example of Eco-Architecture in Malaysia is the Menara Mesiniaga building, designed by Ken Yeang (**Figure 9**). The building was designed according to the local climate and seasons which integrated with the natural landscape. The building was highly recognized globally and received the Aga Khan Award in 1995.

Moreover, eco-architecture seeks to minimize the negative environmental impacts of structure through improved efficiency and the use of sustainable construction materials. As a result, it reduces the consumption of fossil fuels while providing esthetically pleasing structures that are good for the environment. In order to implement eco-architecture in forest environments, it is crucial to understand the key elements of Eco-Architecture which include site context, nature connection, natural processes, environmental impact and people (refer **Table 5**).

Obviously, Eco-Architecture pays attention to the ecological aspects during the planning stage which is soil suitability, site selection, water resources, and waste management. It also utilized the natural elements as to which one is biodegradable, renewable, and clean elements with low-embodied energy for building construction. Eco-architecture is a sustainable architecture that involves a combination of values which are esthetic environmental, social, political, and moral. There is a need to engage in the central aspect of practice, designing and building in harmony with the environment. It needs to rationally think about a combination of issues, including sustainability, durability, longevity, appropriate materials, and sense of place. Thus, Eco-architecture is always one of the best harmonize approaches to maintain the sensitivity of the forest spirit that is suitable to be applied for Forest Education Centers.



Figure 9.

Eco-architecture of Menara Mesiniaga, Selangor, Malaysia (source: AD classics: Menara Mesiniaga/T. R. Hamzah & Yeang Sdn. Bhd (2015). Retrieved from <https://www.archdaily.com/774098/ad-classics-menara-mesiniaga-t-r-hamzah-and-yeang-sdn-bhd>).

ii. Organic architecture

Organic architecture is a philosophy of architecture which emphasizes on the harmony between human habitation and the natural setting. This design approach is also known as democratic and individual and which becomes the factor when one creates a building with the consideration of the environment, the identity, the lifestyle and the uniqueness of the place. Martin Howard & Simon Forty [29] claimed that organic architecture, however, meant that the architect was not only involved in the structure of the building, but the contents as well.

A good example of Organic Architecture is Falling water, designed by Frank Lloyd Wright in 1865–1959 (**Figure 10**) [30]. Falling water had been built at the waterfall and steep slope resulting in a very dramatic view of harmonize composition between natural landscape and manmade structure in the rural area. The design emphasizes on the horizontal striations of stone masonry with daring cantilevers of colored beige concrete that blend with native rock outcroppings and the wooded environment. As Frank Lloyd Wright [30] said:

“A building should appear to grow easily from its site and be shaped to harmonize with its surrounding if nature is manifest there”.

1	Understanding context	Understanding the site contextual with the forest environment is vital before starting any design in a forest. Forests are highly sensitive areas in all aspects, especially on the ecological systems found in the forest. By emphasizing the contextually of the site, it will produce an efficient design without damaging the forest environment. Among the factors to be considered in understanding the context of a forest site are geographical location, temperature, plant and animal habitat, water source, high viewpoint, forest canopy and so on.
2	Connecting with nature	Every building design should have a close relationship with the forest's original state. This is because the design of the building will affect the forest environment. The perfect and beautiful combinations of building structures and natural environment will create a harmonize relationship s with the forest.
3	Understanding natural process	Understanding natural processes in the forests plays an important role to the natural habitat. This is because life in the forest is dependent on each other's ecosystem. Consequently, the impact of the designs in the forest will include the organism's response to their environment and how the organisms are adapting towards the presence of strangers in their habitats.
4	Understanding environmental impact	Environment-friendly designs will have a good impact on the forest environment, the original habitat of plants and animals as well as human beings as a consumer. Careful design planning and the use of natural elements will reduce pollution, as well as conserve and preserve forest areas at it best. This can also reduce the harmful effects towards forest biodiversity.
5	Understanding people as a user	Another factor that is affecting the result of design are humans as the main user. Every space that is designed should consider the individual's needs. After understanding the type of user only then can it be identified according to their needs and types of design. As such, interactions between humans and nature can be harmoniously created.

Table 5.
Key element of eco-architecture.



Figure 10.
Falling water by frank Lyod Wright (source: Falling waters (2017). Retrieved form <https://iknowexpo.org/blog/travel-opportunities-seniors/attachment/falling-waters/>).

The key elements of Organic Architecture are simplicity, style, sympathy with the environment and materials used. **Table 6** below summarizes the key elements of Organic Architecture.

It can be understood here that Organic Architecture has a significant relationship between nature, and its understanding and appreciation, the

1	Simplicity	Simplicity is one of the most important design principles in designing a building in a forest. This is due to the natural and peaceful environment of the forest that makes the concept of simplicity more appropriate. Similarly, the use of finishes that is not overwhelming and the inconceivable design will make the design more harmonize.
2	Style	The style of design is very important to enhance the ideas. Even though it is in the forest, it is still considered important for the purpose of aesthetical and comfort. In addition, the suitability of the style should be harmonizing with the forest environment as well as the local culture. The remarkable style will produce a strong sense of place.
3	Sympathy with the environment	Natural environment with flora and fauna is the key consideration prior to the planning and design works in the forest. Being sympathetic with the forest environment can create a harmonious design and produce effective interactions between building structures, humans and nature. In-depth understanding and mastery of forest situations can make individuals understand the principles of life more and them to become closer to natural environment.
4	The “nature “of materials	The selection of suitable building materials that corresponds to local conditions indicates the simplicity of building structures in the forest. It is more relevant to the forest’s sensitivity due to its existence in living things and its unique view while maintaining the natural concept of forests. Minimizing the selection of materials that will be used is more practical than to diversify them and to harmonize with nature.

Table 6.
Key elements of organic architecture.

use of horizontal expression, logical design, plus appropriate scale and equality in the construction of architectural components. Furthermore, the design style of organic architecture that is characterized by the suitability of the use of materials and structures will shape the identity of an Educational Forest. Hence, Organic Architecture was believed to also fit into the Forest Education Centers where the design that emphasizes simplicity, humility, and respect of nature will benefit the visitors, researchers and the management, as well as enduring in the forest environment.

iii. *Vernacular Architecture*

Vernacular architecture is an approach of design of a building or structure by the skills and expertise of local people without any formal training in design. The design is based on local needs based on a specific time and place which is not replicated from elsewhere. The expertise has been guided by a series of conventions built up in their locality where the consideration of functionality is the dominant factor and the use of local materials is the primary concern. The design tends to evolve over time to respond to the environmental, cultural, spiritual, technological, economical and historical context to become more refined. It is also synonymous with primitive, nomadic or traditional architecture, ethnic architecture and aboriginal architecture.

Kırbaş & Hızlı [31] emphasized that Vernacular Architecture has been an inspiration for innovations in environmental and socio-economically sustainable design and planning. The example of Vernacular Architecture is the traditional Batak house in Sumatra, Indonesia (**Figure 11**), where the use of bamboo and woods with the thatched roofs are commonly practiced. Other materials which are also frequently used depending on the locality



Figure 11.
A traditional Batak house, Sumatra, Indonesia (source: Traditional Batak house (2019). Retrieved from <https://www.britannica.com/topic/Batak/media/55738/119035>).

include clay, wood, animal's skin and others. All those examples have been shown in traditional housing, where the intended climatic and environmental solutions within sustainable design have already been achieved by local implementations.

Vernacular Architecture approach for a Forest Education Center would involve a deep respect and perfect communion with the natural forest environment as well as the perfect relation and understanding of the user's needs. The abundance of forest species may be used as a material with sustainable quantity to make sure it still respects the conservation needs of the forest. The unique local cultural characteristic could be harmonizing with the Forest Education Centre's design language, so the identity of the place will be created in a more meaningful manner. Apart from that, Forest Education Centres also need to take into consideration micro-climatic factors such as lowland dipterocarp forest's setting which has different forest sensitivity from peat-swamp forest or montane forest.

The key elements in deliberating Vernacular Architecture are the climatic influences, cultural significant, environment, construction elements and materials (refer **Table 7**).

In summary, the Vernacular Architecture approach in designing Forest Education Centers will be a large repository of natural and cultural heritage that illustrates a genuine and symbiotic relationship with spirits of the forest. Consequently, the relationship which is mediated through knowledge and values can contribute to the creating of harmonious design in the Forest Education Center itself.

iv. *Green Building*

Green building is a building that reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. It

1 Climate	The influence of climate on vernacular architecture is one of the important factors that affects the overall planning and design. Differences in temperature, light, humidity and wind movement at a place determine the materials to be used in designs, particularly within the forest area. For example, emphasizing on the use of wood is well suited to the tropical climate, furthermore with proper handling and installation, the material will be longer lasting due to its compatibility with climate and local weather. The result of this method makes a building stand up for several hundred years.
2 Culture	Sensitivity to culture as well as understanding the pattern of community life of a place is the key foundation in producing a design that is closer to the way of life of the society. There are similarities and differences in indigenous groups in terms of customs, way of life, interaction patterns that will influence significantly to the size and usage of spaces in Vernacular Architecture. Cultural aspect plays an important role in meeting the objectives and to ensure the successfulness of the design.
3 Environment, construction elements and materials	Natural material found around the local area are the main selection for vernacular building sources. For example, forest-rich wood or bamboo areas will make use of it as a main building material and consequently it affects the style of vernacular architecture. This clearly shows that vernacular architecture is cost effective, quality, affordable, beautiful and durable.

Table 7.
Key elements of vernacular architecture.

is the set of practice of constructing buildings or structures and using processes that are environmentally responsible and resource-efficient throughout a building’s lifecycle from planning to design, construction, operation, maintenance, renovation and deconstruction. According to Samer [32], the “Green Building” is an interdisciplinary theme, where the green building concept includes a multitude of elements, components and procedures which diverges to several subtopics that are intertwined to form the green building concept. Ding & Zhikun [33] further emphasized that the adverse impact of construction on the environment significantly promotes the development of the green building concept worldwide.

In order to achieve a Green Building’s standard, there are several factors that should be considered which includes efficient use of energy, use of renewable energy such as solar, waste reduction measures, enabling of recycling and use of non-toxic materials. It is the consideration of the quality of life of occupants with a design that enables adaptation to a changing environment as well as the quality of the environment in design, construction and operation. The example of Green Building (**Figure 12**) shows the detail features in the building.

Table 8 below lists the key elements in deliberating Green Building which includes resources efficient, in the area of energy; healthy for both physically and psychologically; feeling comfortable, responsive and flexible; and ecologically integrated system of impacts based.

Instantaneously, Green Building is a sustainable or high-performance building. The functionality of Forest Education Centers with the approach to green buildings can improve the harmonious aspects with the surrounding forest environment, users can enjoy healthier atmospheres, free of unnecessary pollution and waste. This approach will provide an excellent impact through the efficient design of the building which can complement the objective of sustainable educational forest

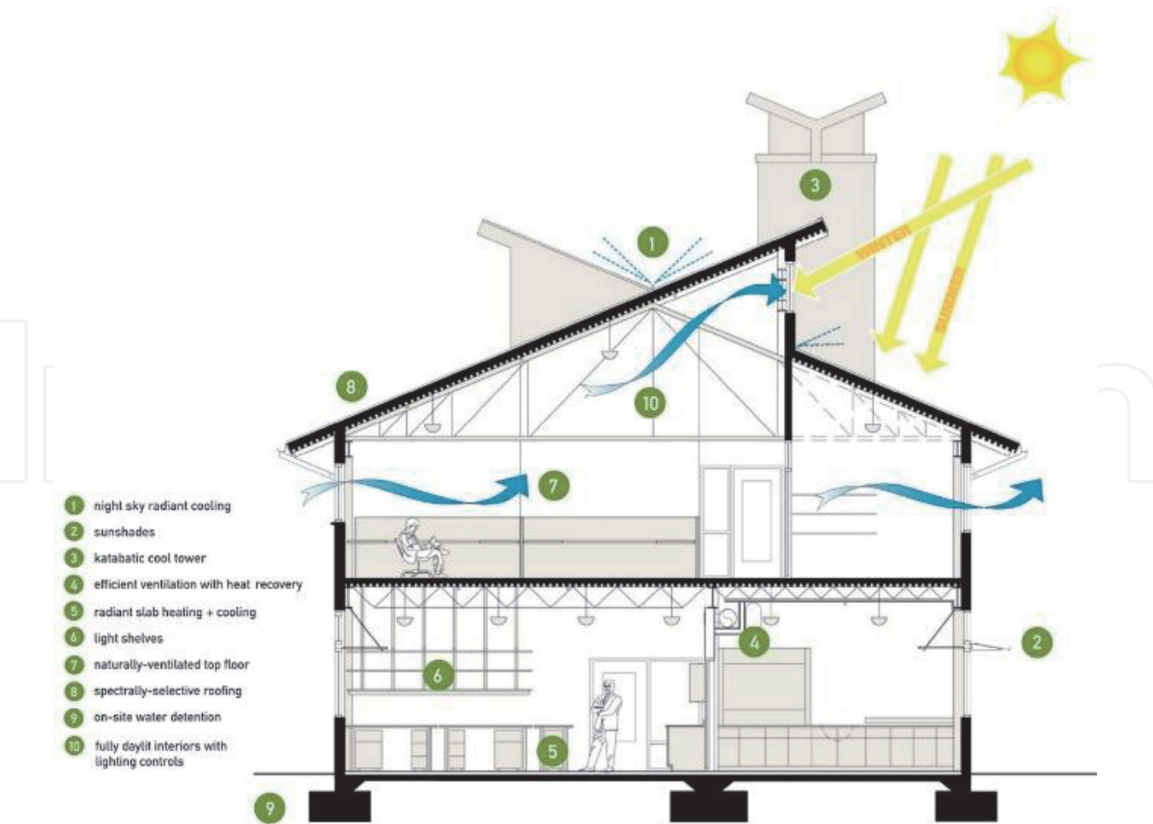


Figure 12.
Features of a green building (source: 14 green building sustainable design images (2012). Retrieved from http://www.newdesignfile.com/post_green-building-sustainable-design_184941/).

1	Resources efficient, in the area of energy	Green building responds to the environmental needs which certainly leads to a better quality of human life. Determining areas that provide a lot of natural energy such as light, water, and wind can make a green building work efficiently in accordance to the environmentally friendly design approach.
2	Healthy, both physically and psychologically	Normally, humans will spend a lot of time in the building as shelters for daily activities. If the built-in design does not consider the user's health, this will make the productivity decrease due to the impact of the deterioration of the user's health while inside the building. Therefore, the application of the green building concept in a design will have a positive impact on both the user and the environment.
3	Comfortable, responsive and flexible	Rationally, the safety and comfort aspects of being in a building are important, besides the basic facilities provided to the user. Evidently, the design of green buildings can provide a comfortable and clean environment without any pollution, especially air and water. The diversity of natural resources' usage in buildings can provide benefits and continuous advantages. Consumers are also free to conduct daily activities with a healthy and positive aura.
4	Ecologically based, particularly as an integrated system of impacts	Basically, this approach also signifies environmental concerns and is aligned with sustainable development concepts. Preserving ecological systems in the forest, for example, should be sustained as not to cause further damage involving the entire inhabitants of the earth. The harmony between buildings design and nature is a major factor in the ecological design.

Table 8.
Key elements of green building.

awareness through research and educational activities. Therefore, this kind of approach would be suitable for forest education centers environment to consider.

8. Conclusion

Forests are significant in our lives and other living things such as animals (e.g. snakes, insects, birds, lions, leopard, monkeys, etc.). Meanwhile, a healthy forest environment is critical for human and animal lives since improper management of this environment would seriously affect humans and animals lives. One of the ways to protect it is by educating people on how to love and manage forests in a proper way.

This study has highlighted that the development of Forest Education Centers must be harmonizing with the forest environment for its sustainability. People will accept these kinds of development when they believed that the development was harmonize with the surrounding and does not give big impact to the environment and their lives. Without proper development planning, it will affect the balance of nature, such as soil, water, air and climate, plants and animals, diversity, characteristic features and beauty and the recreational value of nature as well as the existing and foreseeable land uses. Therefore, harmonize landscape design needs to be prepared for the areas concerned to maintain and regain ecological integrity and enhance humans well-being towards sustainability. It is also necessary to ensure that the proposed landscape elements harmonize with the existing forest environment.

Hence, the forest education center development must be planned before implementation to make sure natural landscape resources (e.g. forests, rivers, hills, waterfalls, stones, etc.) are continuously protected and preserved. It is also to ensure that human-made landscape elements can harmonize with the existing environment. Thus, facilities/infrastructures must conform to environment-friendly, low-impact architecture; renewable including solar energy, waste recycling, rainwater harvesting, natural cross-ventilation, no use of asbestos, controlled sewage disposal, and merging with the surrounding landscape. The design should enhance local architecture, use local materials as well as portraying local art and culture.

Particular attention should be given to local landscape and building traditions, boundary treatments, mix of materials, scale and proportion. New buildings should fit in and make a positive contribution to their surroundings. Where no overriding context exists, efforts should be made to create a positive and distinctive character for the locality with roots in the local character of the District. The basis for any development should be to combine concerns for both sustainability and local distinctiveness.

While seemingly simple to prepare a comprehensive harmonize landscape design and development plan, it remains a challenge because it requires commitment and allocation. We must think ahead for sustainable development in the long run that will provide benefits to all parties, despite the inevitable challenges, which should come first.

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